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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 70

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2 September 1980

USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

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COMPILATION OF DATA ON OPERATIONAL AMPLIFIERS

Moscow RADIO in Russian No 3, 1980 pp 59-60

NAZAROV, Yu. and VOROB'YEV, Ye.

[Abstract] A cut-out compilation is presented of the technical specifications on common operational amplifiers with wide applicability, which covers electric parameters, operational temperature limits and foreign equivalent amplifiers. The report also includes wiring diagrams and K_0 vs f curves for these amplifiers. Figures 1; tables 1.
[263-7813]

UDC 538.561

ELECTROMAGNETIC EXCITATION OF A FINITE ARRAY OF CIRCULAR CYLINDERS

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 637-639
manuscript received 8 Feb 79; after completion, 24 Jul 79

GLUSHTSOV, A. I., Belorussian State University

[Abstract] The problem of electromagnetic excitation of a finite array of parallel circular metal cylinders by a longitudinal dipole source has already been solved. The algorithm of numerical solution follows a separation of variables and application of superposition theorems. Here the merits of this algorithm are demonstrated in the case of a periodic finite plane array of $N = 5-21, 36$ or 72 cylinders at various distances from the excitation source. The algorithm is convenient for analysis of radiation patterns as well as for design of antenna radomes and reflectors. Figures 2; references: 4 Russian.
[273-2415]

UDC 538.574.6

APPROXIMATE SOLUTION OF THE DIFFRACTION PROBLEM FOR A PLANE WAVE AT A HALF-PLANE GRATING PARALLEL TO THE EARTH SURFACE AND ANALYSIS OF THE RADIATION PATTERN OF A VERTICAL ELECTRIC DIPOLE

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 594-602
manuscript received 4 May 79

ASTRAKHAN, M. I. and ZHUKOV, A. D., Leningrad Polytechnic Institute

[Abstract] A simple expression deriving from the Lorentz lemma relates the diffraction of a plane wave at a structure to the radiation of an electric dipole near that structure. Here a structure in the form of a half-plane grating in free space or parallel to the earth surface is considered and the diffraction problem for a plane wave with E-polarization is solved approximately, whereupon the radiation pattern of a vertical dipole at some distance from the grating edge is calculated immediately. The results indicate the dependence of the radiation pattern of an antenna array on the parameters of this array as a diffraction grating and on the ground surface, also how this dependence changes with the elevation angle. Figures 3; references 15: 10 Russian, 5 Western.
[273-2415]

EXTERNAL SYNCHRONIZATION OF SELF-EXCITED OSCILLATIONS IN ACTIVE PHASED ANTENNA ARRAYS

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 547-554
manuscript received 5 Apr 79

DVORNIKOV, A. A., UTKIN, G. M. and CHUKOV, A. M., Moscow Institute of Power Engineering

[Abstract] The principal method of phasing antenna arrays with self-excited oscillators is by synchronization of the latter from an external source. Here the process is analyzed, with the coupling between antenna oscillators also taken into account. The array generally consists of n single-stage oscillators to which synchronizing signals are transmitted through nonresonant channels from one common external oscillator. From the system of fundamental circuit equations are derived the amplitude-frequency characteristics and the stability boundaries. Calculations and instability ellipses are shown for the simplest cases of two antenna oscillators with a purely resistive coupling and with a purely inductive coupling respectively, assuming an optimum coupling between these antenna oscillators and their radiators. The results are extended to n antenna oscillators and the synchronization band is found to become n times wider with all receiving a synchronization signal than with only one of them receiving it. Figures 6; references 9: 7 Russian; 2 Western.
[273-2415]

RADIATION FROM A SYMMETRIC MODIFIED BICONICAL VIBRATOR IN VARIOUS MODES OF EXCITATION

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 603-611
manuscript received 24 Apr 79

GOSHIN, G. G., KRAVCHENKO, G. G. and MYSHKIN, V. G., Siberian Physico-Technical Institute affiliated with Tomsk University

[Abstract] A modified biconical vibrator is an array of uniformly spaced conductors extending radially on both nappes of a conical surface, like its generatrices, all passing through the vertex. The boundary-value problem of its excitation with phased annular δ -function sources has been solved in the approximation of an anisotropically conducting model. Here the hypothesis is verified that a segment of such an array has the characteristics of a broad-band antenna and its radiation pattern is calculated. For this purpose, the original boundary-value problem is

reduced by the Kontorovich-Lebedev transformation to a Wiener-Hopf functional equation and the latter then transformed by standard procedure to an equivalent infinite-order system of linear algebraic equations of the second kind with a completely continuous matrix operator. The radiation pattern with synphasal and with antiphasal excitation respectively is obtained after the field components have been expressed through the Debye potential, the latter in terms of MacDonald functions and associated Legendre polynomials. Figures 5; references 5: 4 Russian; 1 Western in translation.
[273-2415]

UDC 621.396.67.001.5

ANALYSIS OF THE PERFORMANCE OF AN ADAPTIVE ANTENNA SYSTEM WITH TWO AUXILIARY ANTENNAS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 868-872
manuscript received 14 Jul 78

ARZAMASOV, S. N. and MAL'TSEV, A. A.

[Abstract] The problem of noise compensation is considered for a linear equidistant antenna system consisting of one central (principal) and two auxiliary (compensating) antennas. Ratios between the angles of incidence of noise resulting in "critical" situations, in which the eigenvalues of the correlation matrix of stresses in the elements of the antenna system decrease, thus adversely affecting the performance of the antenna system as a whole, are derived. It is shown that, even when the number of noise factors equals the number of the auxiliary channels ("degrees of freedom") of the adaptive antenna system, there exist noise situations in which performance of the antenna system as a whole sharply deteriorates. Figures 3; references 8: 6 Russian; 2 Western.
[259-1386]

UDC 621.396.667.49.001.24

EDGE EFFECT INFLUENCE ON ANTENNA ARRAY PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 703-709
manuscript received 11 Jul 79

KYURKCHAN, A. G.

[Abstract] In a uniform grid the elements distant from its edges can quite reliably be assumed to exist under the same conditions as in an infinite periodic grid. This elementary consideration can be utilized

for design purposes by assuming that in a uniform grid of P elements the central Q elements display identical (correct to the multiplier describing progressive phase advance) current distributions. On the other hand, the currents in the extreme elements ($P-Q$) all vary. In sufficiently large grids or arrays $P-Q \ll P$. On this basis of this assumption, a method for computing the parameters of large antenna arrays (with $>10-12$ elements per row) is proposed, on considering the problem of an array of flanged plane waveguides. An integral equation of field distribution is derived, along with a system of equations representing the waveguide modes, and on this basis a formula for computing the antenna radiation pattern is obtained. This approach can be also applied to problems of scattering on both arrays and bodies, and when applied to engineering calculations, it can produce substantial savings. The author thanks Ya. N. Fel'd for discussion of the work and helpful comments. Figures 3; references 3; 2 Russian; 1 Western in translation.
[259-1386]

UDC 621.396.67.001.24

CORRECTION OF ANTENNA RADIATION PATTERNS BY THE FILTRATION METHOD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 696-702
manuscript received 5 Jan 79

SUDAKOV, O. A.

[Abstract] Adaptive antenna systems entail the problems of correcting their original radiation patterns within a specific range of angles, e.g., when isolating the signal from the target in the presence of noise. In this connection, a filtration technique is considered for solving this problem. The technique is based on the premises of research into the filtration of signals in linear (optical, radio-engineering, etc.) systems, and it is used to construct an iterative scheme of radiation pattern synthesis based on the multiple Fourier transform of the product of the original radiation pattern and the function of the filter. The problem is considered for the case of the rms criterion of the closeness of the synthesized radiation pattern to its specified counterpart. An algorithm for synthesizing the desired function of the filter is presented. The author thanks V. P. Yakovlev for much assistance in the work. References 7: 6 Russian, 1 Western in translation.
[259-1386]

UDC 537.874.4:519.62.001.24

A METHOD FOR COMPUTING MIE COEFFICIENTS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 858-860
manuscript received 19 Jul 78

KOPILOVICH, L. Ye.

[Abstract] Owing to the advances in computers it is now possible to use the exact Mie theory as the basis for the numerical solution of problems of the scattering of electromagnetic waves by systems of homogeneous spherical particles, e.g. problems of the scattering of radio waves in rain. However, the computational procedure can be still further lightened by calculating the Mie coefficients by a newly presented procedure based on resorting to a complex Riccati equation. Under this procedure, the selection of the path of integration depends on whether y is a complex or a real number. The corresponding systems of equations are derived. Figures 1; references 3: 2 Russian; 1 Western in translation.
[259-1386]

UDC 538.245

SPECIFICS OF FORMATION AND EXISTENCE OF GRIDS OF MAGNETIC BUBBLES

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 279-282
manuscript received 6 Jun 79

DOVGIIY, V. T. and SHAPOVALOV, V. A.

[Abstract] Studies are made of the specifics of formation and existence of grids of magnetic bubbles with various parameters on films of epitaxial ferrite-garnet over a broad range of bias fields. The experimental curves show that for a certain bias field there may be several fixed grids with different parameters but identical complete energy density. The authors thank V. G. Bar'yakhtar and Ye. F. Khodosov for helpful discussion of the work. Figures 5; references 5: 3 Russian; 2 Western.
[253-6508]

INTERFERENCE-STABILITY OF ACCUMULATORS IN STATIC BIPOLAR MAIN MEMORY CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 209-219
manuscript received 15 Nov 79

BARINOV, V. V. and ORLIKOVSKIY, A. A.

[Abstract] A method is suggested for studying the interference stability of accumulators made of bipolar transistor structures, and an approach is presented for calculation of the static and peak interference stability of accumulators to internal noise in integrated memory circuits. It is suggested that static interference stability be based on calculation of the discharge characteristics of memory elements, and it is demonstrated that the peak interference stability, based on amplitude-time characteristics, must also be evaluated for accumulators. The method allows quantitative requirements to be determined for such important parameters as storage and sampling currents, information capacity of the accumulator, and determination of the need to use additional measures to increase the interference stability of accumulators, for example the use of special circuits for determination of potential levels on discharge lines and circuits for acceleration of the recovery of potentials on word lines. Figures 5; references 11: 8 Russian; 3 Western.
[253-6508]

SYNTHESIS AND SELECTION OF HIGH SPEED VLSI DECODERS BASED ON BIPOLAR STRUCTURES

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 220-235
manuscript received 15 Nov 79

PODOPRIGORA, N. A.

[Abstract] Earlier works have studied the general problems of construction of decoders and optimization of digital devices, but have presented practically no materials on the problems of synthesis and selection of full decoders for LSI memory units. The purpose of this work is to fill this gap. The synthesis of the electric circuits of full bipolar decoders is analyzed and various types of decoders are compared. The methods and equations outlined allow engineering estimates to be made and the selection of the most promising types of decoders to be performed. The next step will be more precise computations performed by computer. Figures 6; tables 6; references 15: 10 Russian; 5 Western.
[253-6508]

DISCHARGE CHARACTERISTICS OF A GaP-CdS-CdSe-Ni HETEROSTRUCTURE

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 259-263
manuscript received 14 Nov 79

POLYAKOV, V. I., PEROV, P. I. and AVDEYEVA, L. A.

[Abstract] A preliminary study is presented of the surface electron states and surface charge of a GaP-CdS-CdSe-Ni heterostructure which exhibits optical memory, in that the optical parameters of the semiconductor materials of the structure are altered in an electric field created by a captured electron charge at the CdS-CdSe boundary when the electrons are injected from the metal Ni electrode. The method of physical studies suggested is promising for analysis of the parameters of surface electron states in Schottky contacts, homo- and hetero-junctions, particularly when there are slow surface electron states and small values of time constants of the structure studied. Figures 3; references 5: 3 Russian; 2 Western.
[253-6508]

THE STRUCTURE OF FLAT CIRCUITS CONSIDERING STRUCTURAL LIMITATIONS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 202-207
manuscript received 5 Oct 79

PRATUSEVICH, M. L. and SEL'YUTIN, V. A.

[Abstract] In recent years, the topologic method of planning of circuits with one connecting layer has been widely developed; the essence of the method is that the circuit being planned is represented as a mathematical graph which is subsequently planarized, which determines the location of the elements and interconnections on a plane providing for the minimal number of crossings of interconnections. An algorithm is presented in this work for planarization of the graph of a circuit, which allows consideration of the sequence of leads of each element, either rigidly assigned or assigned as a possible mirror reflection. The basic algorithm is described. Peculiarities of its practical utilization are mentioned. The use of the concept of the semifixed node allows structural limitations to be considered in constructing flat realizations of circuits more simply than by the use of a "wheel" model. Figures 4; tables 1; references 9: 5 Russian; 4 Western.
[253-6508]

ELEMENT OF MULTIPARAMETRIC MEMORY

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, 1980 pp 27-28

KOLOMIYETS, B. T., doctor of technical sciences, ANDREYEVA, G. A., LEBEDEV, E. A., TAKSAMI, I. A. and SHPUNT, V. Kh., candidates of physicomathematical sciences

[Abstract] Switches and memory elements consisting of an active layer of chalcogenic vitreous semiconductor (CVS), enclosed between two metallic electrodes, are characterized by the presence of two states--high and low resistance. These elements have symmetric volt-ampere characteristics (VAC) and they can only register the passage of a pulse with an amplitude exceeding the voltage threshold. In order to expand their capability, CVS layers with metal additives are studied in the present paper. It is established that proper selection of the preparation conditions and CVS with metal pairs yields elements with new properties. The characteristics of elements with the active layer $\text{CVS:Si}_{1.2}\text{, Ge}_{1.0}\text{, As}_{3.0}\text{, Te}_{4.8}$ and addition of silver are reported. The mechanism of multiparameter memory is directly related to the behavior of silver in CVS. Silver ions can shift quickly under the influence of an electric field. With passage of a current, metallic filaments begin to form, closing the gap between the electrodes. This leads to stationary low ohmic state of the VAC. Reversal of the polarity reverses this phenomenon. The inertia of these processes gives rise to the effect of multiparametric memory. Figures 7, references 5: 3 Russian; 2 Western. [257-7813]

UDC 621.3.015.532.083

RECORDING OF CORONA DISCHARGE CURRENTS AT THE OSTANKINO TELEVISION TOWER

Moscow ELEKTRICHESTVO in Russian No 5, May 80 pp 41-44 manuscript
received 10 Jan 79

GORBUNOVA, G. Yu. and GORIN, B. N., Institute of Power Engineering imeni
G. M. Krzhizhanovskiy

[Abstract] Systematic measurements of corona discharge currents had been undertaken at the Ostankino television tower, for the purpose of gathering data on the dependence of these currents on cloud structures and weather conditions. As one electrode a tubular lightning arrester 1.2 m long and 28 mm in diameter was used with a conical tip, standing on top of the 540 m tall tower. As the other electrode 16 m below at various locations around the tower served interchangeable rods 800 m long and 10 mm in diameter, a smooth sphere 120 mm in diameter, and spheres 120 mm in diameter spiked with 40 needles 50 or 150 mm long. The measurements were made during 22 spring-summer-autumn months in the 1972-75 period. From the 152 recorded coronograms there emerge three basic modes of current variation with time: smooth without spikes, smooth with isolated spikes superposed, and smooth with frequent spikes superposed. These data, together with available thunderstorm statistics and an evaluation of shielding effects, can serve as the basis for broadcasts of storm warnings and reports. Figures 5; references: 4 Russian; 1 Western in translation. [272-2415]

ON THE STABILITY AND PHASE-MEMORY PROPERTIES OF MULTICHANNEL CONTINUOUS-PULSE PHASE-LOCKED AUTOMATIC FREQUENCY TUNING SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 763-770
manuscript received 21 Nov 77; after revision 30 Jan 79

ZHILIN, N. S. and TISHCHENKO, S. P.

[Abstract] The use of pulsed phase-locked automatic frequency tuning systems (IFAPCh) in the frequency division and multiplication modes serves markedly to improve the quality of the isolation and processing of the information contained in the phase difference between input signals in phase devices. In this connection, the stability of pulsed IFAPCh is analyzed with respect to a finite magnitude of the electrical channel connections and the consequent presence of the direct synchronization of IFAPCh-tuned generators by an external synchronous signal arriving from the adjacent channels. It is shown that system stability in the neighborhood of the equilibrium point is determined by the form of the roots of the corresponding characteristic equation. On the basis of this and other stability conditions, an estimate of the error of phase-memory devices based on multichannel pulsed IFAPCh is presented. Figure 1; references 8: 7 Russian; 1 Western.
[259-1386]

FERRITE MAGNETIC CIRCUITS

Moscow RADIO in Russian No 3, 1980 p 16

MALININ, R.

[Abstract] A simple ferrite is a binary compound of metal oxides, usually iron oxide chemically bound with oxides of such compounds as nickel, manganese, lithium, zinc, cadmium, barium, cobalt, strontium or some other divalent metal. The most commonly used ferrites in radioelectronics are the so-called solid solutions of two or more simple ferrites, for brevity also called ferrites. Magnetic circuits in the coils used for transformers, magnetic antennae, magnetic caps and other components of radio-electronic equipment are made of ferrites with low coercive induction power, normally called magnetically soft ferrites. Initial magnetic permeability of these ferrites may vary from a few to thousands of units. Basically there are two types of magnetic circuits: closed and open. Various methods of coding these circuits are explained in the article. Figures 1.
[263-7813]

DEVELOPMENT OF OPTICAL SYSTEMS AND COMMUNICATION CABLES

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 33-37 manuscript
received 3 Jan 79

GRODNEV, I. G. and MURADYAN, A. G.

[Abstract] Under Soviet leadership, great progress has been made in the development of electrical communication systems. Up to 1941 the communication net consisted mainly of overhead lines. Cables were introduced in the mid-fifties, converting to the coaxial multichannel transmission systems. Most recently, a satellite communication network was established and optical cables are being introduced in many locations. The introduction of optical cables is sometimes compared with the introduction of transistors in electronics. Optical cables consist of optical fibers twisted in a predetermined pattern and covered with a plastic film. Construction of the cables and preparation of optical fibers are reviewed. A transmission system based on an optical cable network is discussed. One of the more important parameter of an optical cable line is the regeneration segment, because the signals do fade away in such cables. Figures 8; tables 3; references: 7 Russian.
[261-7813]

UDC 621.315.23

BALANCED HIGH-FREQUENCY CABLES IN ALUMINUM AND STEEL SHEATHS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 28-43 manuscript
received 30 Nov 79

BARON, D. A. and LAKERNIK, R. M.

[Abstract] For 30 years balanced high-frequency cables with lead sheaths were used. They were very effective in various communication networks. However, because lead is an expensive metal with limited reserves, it was necessary to look for substitutes. Steel and aluminum sheaths appear to be just as effective, indeed surpassing the lead coatings in some respects. A large network has already been laid and these new sheaths have proven themselves. Only isolated cases of corrosive defects were found. Aluminum coated cables are seven times less vulnerable to lightning than lead cables. The article reviews the electric and physical-mechanical properties, the protection of aluminum and steel sheaths from corrosion and the methods used for joining these cables. Figures 4; tables 3; references: 9 Russian.
[261-7813]

ANALYSIS OF CONDITIONS AFFECTING THE PROPAGATION OF SIGNALS OF DECAMETER WAVELENGTHS OVER LONG ROUTES

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 630-631
manuscript received 10 Jul 79

KURKIN, V. I., ORLOV, I. I. and POPOV, V. N., Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, Siberian Department of the USSR Academy of Sciences

[Abstract] Earlier theoretical predictions pertaining to propagation of decameter radio waves, based on the method of normal waves in the adiabatic approximation with time-averaging of the radiation energy and assuming an isotropic earth-ionosphere waveguide, were checked against experimental data including the amplitude characteristics of direct and reflected signals. Measurements were made with signals at the 10 MHz frequency during the voyage of the scientific-research vessel "Borovich" from 24 February to 23 March 1975. Semiempirical models of the ionosphere with corresponding profiles of the electron concentration and of the effective collision frequency were used for the analysis. Only a few discrepancies were found such as reception of direct signals during evening hours, not predicted because of a somewhat lower than 10 MHz theoretical maximum receivable frequency, and higher or lower absolute values of effective energy density due to not a full accounting for the characteristics of the receiver-transmitter channels. A close agreement can be established, however, by approximating the dependence of the maximum energy density on the distance with a decaying exponential relation. The authors thank the ionospheric research team under the direction of professor V. M. POLYAKOV for providing the ionosphere data, without which this study could not have been made. Figures 2; references: 5 Russian. [273-2415]

UDC 621.391.2

SUBOPTIMAL ADAPTIVE FILTERING FOR A CLASS OF LINEAR MODELS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 758-762 m
manuscript received 17 Jul 78

PONOMAREV, Ye. P.

[Abstract] The solution of the problem of filtering a signal with unknown parameters from a mixture with noise requires adaptation of the filter, which can be accomplished either by constructing an expanded vector of estimates or replacing the unknown parameters with their consistent

estimates. The former approach requires ponderous computations. In this connection, the possibility of simplifying these computations by utilizing a signal model admitting the successive estimation of parameters is considered. Filter adaptation is thus accomplished by utilizing the properties of the renewal process and through the interaction of estimation and filtering units. A corresponding algorithm for suboptimal adaptive filtering is derived with respect to linear models of the cascade type (assuring successive estimation of parameters). Figures 3; references 7: 4 Russian; 3 Western.
[259 1386]

UDC 621.391.2.001.24

RECEPTION OF A RANDOM SIGNAL OF UNKNOWN FREQUENCY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 749-757
manuscript received 27 Feb 79

TRIFONOV, A. P.

[Abstract] The reception of a Gaussian random band signal with a rectangular spectral density and an unknown central frequency against background of Gaussian white noise is considered. The maximum likelihood method is used to process the signal. Approximation formulas for the characteristics of the device based on this method--the maximum likelihood receiver--are derived, especially asymptotic formulas for the bias and variance of the maximum likelihood estimates of central frequency and spectral density. The accuracy of these formulas increases with increase in observation time and in the a priori material for the determination of the unknown frequency. These formulas become markedly simplified if the probability of an anomalous error of frequency estimation is negligibly small. References 17: 12 Russian, 5 Western (3 in translation).
[259-1386]

UDC 621.391.14

NOISE IMMUNITY OF A QUASI-OPTIMAL ADAPTIVE RECEIVER OF NOISE-TYPE SIGNALS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 56-60 manuscript
received 30 May 79

VARAKIN, L. Ye. and TALYZIN, V. N.

[Abstract] Control of interference in communication systems using noise-type signals led to the development of adaptive methods of reception. Most adaptive receivers are multi-channel, each channel contributing to

the total effect in proportion to the signal amplitude-to-interference ratio in each particular channel. A theoretical basis for separating the signal from the noise has been adequately developed. Practical realization is rather complex, however. Therefore quasi-optimal receivers are developed which are not optimal in terms of the interference stability but are practically achievable. Such a receiver is discussed in this article, with a mathematical analysis of the situations of uniform and non-uniform distribution of interference among the channels. Figures 2; references 11: 10 Russian, 1 Western.
[261-7813]

UDC 621.394.1:591.216

ACCURACY OF COMBINED ESTIMATION OF FREQUENCY AND SPACE CHARACTERISTICS OF RADIO SIGNALS WITH THE AID OF AN OPTIMAL PROCESSING DEVICE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 865-868
manuscript received 14 Dec 77; after revision 26 Feb 79

KATKOV, B. G.

[Abstract] The solution of certain radar and radio communication problems requires the combined measurement of the frequency and direction of arrival of radio signals. In the present communication, the accuracy of such combined measurements is compared with the accuracy of discrete measurements. The problem is examined with respect to a coordinate system in which a linear antenna is centered at the coordinate origin, and assuming that the signal received by the antenna represents an additive mixture of the actual signal and space- and time-uncorrelated noise. The complex function of signal indeterminacy is derived from the general formula for the signal indeterminacy function. It is shown that in discrete measurements of the frequency and angle of incidence of the signal the accuracy achieved is lower than in combined measurements of both parameters, owing to the attendant higher correlation between the signal frequency and θ ($\sin \vartheta$, with ϑ representing the angle between the normal to the antenna plane and the direction of incidence of the signal). This makes it possible, when a large-aperture antenna is used, to enhance the accuracy of frequency measurements by measuring the spatial characteristics of radio signals. Measurement time can then also be reduced. Figures 2; references: 2 Russian.
[259-1386]

SOME MEANS OF INCREASING THE EFFECTIVENESS OF RADIO TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 26-32 manuscript received 26 Dec 79

BORODICH, S. V.

[Abstract] Effective communication is based on most economical transmission of the highest number of messages. This problem is analyzed from the aspect of the three most common transmission systems: direct contact radio relay, troposphere radio relay and satellite transmission systems. Increased effectiveness of radio transmission systems may be viewed as an increased signal output ability at a given bandwidth and signal-to-noise ratio. One of the ways to increase the effectiveness of the transmission system is to control transient interference: this can be done by careful selection of the signal routes; another method is based on amplitude modulation. The principal factor limiting the transmission ability of a tropospheric radio channel is the multiradial signal structure with rapid fade out and considerable transient interference. The "Accord" and "Saturn" systems for controlling the interference in tropospheric lines are discussed. Satellite stations produce practically constant radio signals. To increase the effectiveness of their transmissions, multiradial antennae must be used focusing on relatively narrow zones on the earth surface. Figures 4, references 16: 12 Russian, 4 Western. [261-7813]

THE STATE OF TECHNICAL OPERATIONS OF A RADIO RELAY NETWORK AND THE TASKS AIMED AT INCREASING ITS PERFORMANCE QUALITY

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 43-45

MORDOVIN, S. P.

[Abstract] Radio relay lines are presently the most important means for transmission of communications within the country. They transmit color and monochrome TV programs, telephone traffic, telegraph messages, etc. The variety of equipment utilized in networks makes servicing, maintenance and replacement very difficult. To improve the performance of radio relay lines, some of them must be thoroughly overhauled. To do this, some of the regulations of technical operations must be updated. Other suggested improvements include: better design of new lines, training of cadres to be employed at a radio relay network, creation of reserve channels with a system of rerouting in case of emergency and improvements

in centralized network control, including calibration of the measuring equipment. This paper is based on a report presented at the 1979 Chelyabinsk Seminar on Problems of Increasing the Quality and Reliability of the Operation of Radio Relay Lines.
[261-7813]

UDC 621.396.4

RECONSTRUCTION OF A RADIO RELAY TRUNKLINE WITHOUT INTERRUPTION OF THE COMMUNICATION SERVICE

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 45-47

GERTSVOL'F, V. A.

[Abstract] The principle task in reconstruction of radio relay lines is the ability to perform a series of disassembly, service and reassembly tasks without cutting the communication lines. As an example, replacement of "Rassvet" equipment by "Voskhod", which was carried out without any interruption of services, is discussed. The exchange was worked out in seven stages. Careful planning and adherence to the schedule appeared to be all important. This paper is based on a report presented at the 1979 Chelyabinsk Seminar on Problems of Increasing the Quality and Reliability of the Operation of Radio Relay Lines.
[261-7813]

UDC 621.396.4

ANALYSIS OF THE DOWN TIME OF RADIO RELAY TRUNKS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 48-50

RAKOV, A. I.

[Abstract] In the design or reconstruction of radio relay lines, one of the most important components is their operational reliability. To be able to calculate this, it is necessary to know the expected down time of the equipment. This was found to vary from less than 0.3 second to several hours. Yet annually the proportion of idle time of less than 3 minutes appears to increase (the first year of operation it is in the range of 61.3 percent, during the second - 76.2 and in the third year - 86.2 percent). An algorithm is constructed and theoretical values calculated from it are found to agree well with experimental observations. Because of the fact that the number of down times exceeding 3 minutes is low, an approximation could be made in calculating the projected idle

times for new equipment, namely that the idle time duration is distributed exponentially. The paper is based on a report presented at the 1979 Chelyabinsk Seminar on Problems of Increasing the Quality and Reliability of the Operation of Radio Relay Lines. References: 2 Russian. [261-7813]

UDC 621.396.4

TV PROGRAM SWITCHING SYSTEM AT RADIO RELAY JUNCTION CENTERS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 50-52

ZHEREBTSOV, A. L.

[Abstract] In connection with the rapid development of radio relay networks, the number of junction centers has markedly increased. Manual switching of TV programs is now out of the question and consequently a complex automatic system has been designed which permits only control at the junction stations, but also remote control of the equipment. The equipment consists of a stand for the electronics of the switching operations, a control and operation master desk and a sound and TV monitor. All of this equipment was built with domestic semiconductor units, the signal switching being performed in rapid contactless electronic switches. At maximum capacity, this equipment is designed to operate two trunkline relay stations which beam a double TV program and one duplex cable line. The paper is based on a report presented at the 1979 Chelyabinsk Seminar on Problems of Increasing the Quality and Reliability of the Operation of Radio Relay Lines. Figures 5. [261-7813]

UDC 681.7.068.001.5

TWIN-LAYER OPTICAL FIBERS WITH A LOOSELY FITTING ABSORBING SHEATH

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 673-678
manuscript received 14 Jun 79

FEL'D, S. Ya. and FOYGEL', A. V.

[Abstract] Twin-layer optical fibers with a high numerical aperture represent promising materials for short-distance communication lines. Their high numerical aperture is caused by the use of polymers with a low refractive index as the light-reflecting sheaths. However, the polymers technologically suitable for this purpose usually display a high (of the order of 1000 dB/km and more) absorption in the visible

and IR regions of the spectrum, which contributes to losses in such guides. To reduce these losses a new guide design based on the use of a loosely fitting polymer sheath has been proposed: the presence of a clearance between the surface of the core and the absorbing sheath should result in a marked reduction of the part of losses caused by absorption in the sheath. In this connection, the effect of such clearance is investigated for twin-layer (step-index) optical fibers consisting of a circular core of a low-absorption material (e.g., fused quartz or multicomponent glass) clad in a sheath of a polymer high-absorption material. It is shown that clearances of up to 20 micrometer between the core and the sheath increase the losses in the guide by only 1.5 dB per 500 m segment of guide (wavelength 0.85 micrometer), thus making guides of this kind suitable for use in short-distance communication lines. Figures 4; references 7: 2 Russian, 3 Western.
[259-1386]

UDC 621.372.8.001.24

COMMENTS REGARDING S. B. RAYEVSKIY'S ARTICLE "ON CERTAIN PROPERTIES OF
COMPLEX WAVES IN TWO-LAYER CIRCULAR SHIELDED WAVEGUIDES"

Moscow RADIOTAKHIKA I ELEKTRONIKA in Russian No 4, 1980 pp 887-888
manuscript received 9 Feb 79

VESELOV, G. I., PLATONOV, N. I. and SEMENOV, S. G.

[Abstract] S. B. Rayevskiy provided a tentative physical interpretation of the nature of complex waves in connection with the fact that one of the most interesting properties of a smooth orienting structure having the form of a circular metal waveguide with a dielectric core is the possibility of the existence of electromagnetic oscillations with complex propagation constants (the so-called "complex waves"). Rayevsky concluded that in the absence of losses the power of each complex wave is non-zero. But it is now shown that such a conclusion conflicts with the general energy formulas ensuing from the Lorentz lemma and applying to any waveguide structure with an inhomogeneous metal-dielectric filler, e.g. a shielded dielectric waveguide. Through an analysis of formulas for two complex waves with different propagation constants (i.e. with two different phase-velocity directions), it is shown that the power transmitted by a complex wave across the waveguide cross section is zero. Figures 1; references 7: 8 Russian; 1 Western.
[259-1386

UDC 531.74.087.92

CONTACTLESS KVP-100 POSITION SENSOR

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, 1980 pp 33-34

KIMELIDZE, M. P. and MANAGEISHVILI, V. A., engineers

[Abstract] In the construction and maintenance of railroad lines, tie tamping machines are used, which operate automatically except for halting the machine over the tie being handled. Existing position sensors show many shortcomings. An improved contactless position sensor developed at the Special Design Office Proyektpribor [Instrument Design], Kutaisi is described in the present paper. In principle this unit consists of the primary converter and a measuring circuit located in one casing. In 1978, a batch of prototype sensors was field tested with positive results. Series production should start in 1980 at the Tallin Instrument Building Plant Tallin PO "Prompribor". Figures 1.
[275-7813]

UDC 681.335.5

INTEGRAL ANALOG MULTIFUNCTIONAL CONVERTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, 1980 pp 34-35

MASHENKOV, V. M., MURSAYEV, A. Kh, candidates of technical science, OSETINSKIY, P. S. and KHRISTOLYUBOV, V. A., engineers

[Abstract] The type KMP8IT301 analog multifunctional converter was developed by the All-Union Scientific-Research Institute of Electrical Measuring Instruments (VNIIEI) together with the Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin). Series production of the device was started in 1979 at the L'vov plant "Mikropribor." It consists of an analog time-pulse multiplication-division device (MDU), capable of averaging the duration-modulated pulses. To improve the dynamic characteristics of this unit, the principle of current switch-over was used. Technical characteristics, structural schematics and functional capabilities of the device are described. A number of potential uses for this generator are listed. Figures 1; references: 2 Russian.
[257-7813]

UDC [621.3.015.51:546.212],001.24

CALCULATION OF THE ELECTRICAL STRENGTH OF DISCHARGE GAPS IN WATER

Moscow ELEKTRICHESTVO in Russian No 3, May 80 pp 36-41 manuscript
received 23 Oc: 79

KUZNEKIN, I. P., candidate of technical sciences, and KALENIKOV, A. V.,
engineer, Power Engineering Institute, Moscow

[Abstract] Water serves as an insulator or as an impregnator of polymer film insulation in equipment such as megavolt pulse shaping lines. Here the relations are summarized which pertain to the electrical strength of water gaps, relations based on an analysis of consecutively heating, breakdown and discharge kinetics. The boiling point of water at any time is not exactly known, because of changes in the pressure during these processes, but the electrical conductivity of water is assumed to be a linear function of the water temperature. The temperature coefficient of electrical conductivity depends on the kind and the concentration of ionic solute, as well as on the electric field intensity. Voltage-time characteristics are used for calculating the energy input to a gap and the equivalent gap resistance. From these relations are in turn determined the gap dimensions, the breakdown efficiency as a function of the interelectrode distance, and the maximum interelectrode distance at which breakdown will still occur. Figures 4; references 11: 8 Russian; 1 East German.
[272-2415]

UDC 621.313.13

IMPROVING THE OPERATIONAL RELIABILITY OF ELECTRIC MOTORS FOR THE IN-HOUSE NEEDS OF ELECTRIC POWER STATIONS

Kiev ENERGETIKA I ELEKTRIFIKATSIYA in Russian No 2(104), Apr/Jun 80
pp 12-15

BEZPROZVANNYY, A. A., candidate of technical sciences, NEMINOV, A. I.
and NESTEROVA, T. M., engineers, Kiyevenergo Industrial Power Association

[Abstract] A report on work done in recent years by TsNIEL [expansion not given] of the Kiyevenergo Industrial Power Association in order to improve the reliability of electric equipment for the in-house needs of fossil-fuel power plants. This research included calculation and experimental verification of self-starting of sections for in-house needs, investigation of working conditions and analysis of causes of damage to in-house electric equipment, plotting the starting characteristics of electric motors, updating electric motors that operate under the most severe working conditions. The studies of self-starting showed the maximum duration of

an interruption in the in-house power supply that ensures successful self-starting of the electric motors, and revealed deficiencies in the technological and electrical arrangements of the station that would be very difficult to determine theoretically. The following recommendations are made for improving the reliability of the in-house power supply and motor operation: 1) The time of interruption of the in-house supply due to operation of the automatic switchgear for activating the standby equipment should be in a range of 0.4-0.5 s; 2) To ensure reliable self-starting of 300 MW generators with a supply interruption lasting from 1.5 to 2.5 s, one turbine regulating pump must be powered from a reserve source or from the busbars of the next generator; and 3) In electric power plants that use PE-380/185/200 and PE/580/185 feed pumps with AS-4000/6000 and AS-5000/6000 motors, there should be a delay of 0.5 s in operation of the pressure-reduction protection. Damage to the stator windings of electric motors can be reduced by more secure fastening of the slot and face sections of the windings and leads, and also by improving starting conditions or reducing the number of starts. Starting conditions can be improved by reducing starting currents and shortening starting time. Tables 1.
[264-6610]

UDC 621.314.632.001.5

SCIENTIFIC AND TECHNICAL PROBLEMS IN CONVERTER ENGINEERING

Moscow ELEKTRICHESTVO in Russian No 5, May 80 pp 5-9

LABUNTSOV, V. A., doctor of technical sciences, Moscow

[Abstract] Converter engineering covers the development, construction and application of electrical equipment for conversion of electric energy from one form to another by means of rectifiers. Power semiconductor devices are the base of this equipment, recent improvements including a higher unit power and a faster response as well as better reliability. Problems still remain with a wide variance of performance parameters, high control voltages and high firing currents, all obstacles to size and cost reduction. New devices with higher performance indicators have been produced: thyristor-diodes, thyristors with combination switching, two-operational thyristors and power transistors. Particularly interesting are series manufactured power thyristors with optron control. The trends in converter engineering parallel those in semiconductor devices on the one hand and those in electric drives on the other. Here the trend is increasingly away from d.c. toward a.c. Outstanding examples are speed regulation of squirrel-cage induction motors, by means of either an autonomous inverter or direct frequency conversion, synchronous motors with "flying" diodes replacing the commutator; frequency conversion for

electric traction and diverse electrical manufacturing processes. On the other hand there is steady progress made in d.c. transmission lines. One main set of problems in converter application is electromagnetic compatibility with the supply source, involving distortion and inefficiency. Simple use of corrective capacitors and tuned filters are not the best answer inasmuch as combination filter-compensator devices or asymmetric controls built into the converter are more promising. The second set of general problems in converter design is providing adequate cooling and protection. The third set of problems is reliability, with the necessary testing and diagnosis. The use of digital computers in all phases of converter engineering has greatly contributed to the solution of many problems and made all-encompassing automated design of converters feasible. This paper is based on a report made at the All-Union Conference on Automatic Control of Electric Drive, Tashkent 1979.
[272-2415]

UDC 621.315.623.5.027.3

SELECTION OF SHIELDS FOR INSULATOR SUPPORT STRUCTURES

Moscow ELEKTRICHESTVO in Russian No 5, May 80 pp 47-49 manuscript received 26 Apr 79

ZARGARYAN, I. V. and SLUTSKIN, L. S., All-Union Institute of Electrical Engineering imeni V. I. Lenin

[Abstract] High-voltage equipment such as insulators require shields for limiting the intensity of corona discharge at their surfaces. These shields affect the electrical strength of the protected structure, but the problem of optimizing their principal dimension for maximum electrical strength of the structure has not yet been solved. Here the radius of such a shield is calculated on the basis of the integral criterion $\int^H E dh$ (E denoting the electric field intensity and H denoting the height of a structure segment). As the upper limit of this integral, the critical length was established of the streamer zone necessary for a stable streamer buildup process. It has been determined experimentally from measurements of the field intensity distribution during discharges. A wireless light system was used for signal transmission from the probe at high potential to the recording instrument at ground potential. The intensity curve was found to depart from the $E = k \cdot V$ relation immediately after the beginning of a corona discharge and to vary at random till breakdown corresponding to maximum intensity. In the presence of a space charge, moreover, the field distribution was found to be highly nonuniform. The integral is evaluated with the aid of a digital computer, whereupon the shield radius is found graphically, as a function of this integral for an assumed "shield to plane" configuration of the gap. Figures 1; references 7: 6 Russian; 1 Western.

[272-2415]

IMPROVEMENT OF HIGH-VOLTAGE CIRCUIT BREAKERS

Kiev ENERGETIKA I ELEKTRIFIKATSIYA in Russian No 2(104), Apr/Jun 80
pp 27-29

KLIMENKO, V. Ya., engineer, Kiyevenergo Industrial Power Association

[Abstract] A brief report is presented on steps taken to update circuit breakers in the Kiyevenergo power grid to bring them into line with the requirements of State Standard GOST 687-70. In 1977 there were 52 series VVN and VMK 110kV breakers in the system, and 17 VVN-330-15 and VV-330B breakers with switching capacity lower than the short-circuit current in the power grid. In addition there were 45 type MG-110 and 340 type VM-35 breakers that were out of date and unable to handle the short circuit currents for which they were rated. In 1977-1978, 35 of the VVN-110-6 breakers were updated by installing RBShN-6, RBShN-5 and RBShN-4 shunting resistors made of Betel composition material based on a cement binder. Nine VVN-330 breakers at the Tripol'sk State Regional Electric Power Plant are now being brought up to a current of 40 kA by installing Betel resistors. An updated pneumatic system is to be installed in all VVN-110-6 air breakers in the Kiyevenergo power grid; so far 38 breakers have been updated in this way. All the VM-35 breakers will be improved by replacing the existing spring-loaded drive with the PE-11 electromagnetic drive. The VMK-110 and MG-110 breakers in the system are being replaced with U-110 and MMD-110-1250 circuit breakers. Plans for 1980 call for updating series VV-330B breakers by installing Betel resistors, and all MKP-35-1000 breakers by replacing chambers and movable contacts in order to increase the current-handling capacity. Figures 1.
[264-6610]

UDC 621.382

EXCITATION OF SURFACE ACOUSTICAL WAVES IN NON-PIEZOELECTRIC CROSSED ROD CONVERTERS WITH ZnO FILMS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 277-279
manuscript received 5 Oct 79

ANDREYEV, A. S., ANISIMKIN, V. I., KOTELYANSKIY, I. M., MOROZOV, A. I.
and SHASHKIN, S. b.

[Abstract] An experimental study is made of the excitation of surface acoustical waves on crossed-rod converters with films of ZnO on S79-2 glass. The temperature coefficient of delay for surface acoustical waves on this material is about 10^{-6} C^{-1} , making it promising for surface acoustical wave delay lines. The method was developed for producing textured films of ZnO by precipitation of the oxide in a triode system in an atmosphere of argon and oxygen. The technology allowed production of films 0.2-5 micrometer thick with an orientation of the texture axis either perpendicular or parallel to the plane of the substrate. The measured variations of K^2 as a function of h/λ of the same nature as in a system consisting of ZnO and fused quartz. The frequency dependence of the losses induced in the delay line is illustrated. Figures 2; references 16: 8 Russian; 8 Western.
[253-6508]

UDC 681.881

PERFORMANCE OF ACOUSTIC ECHO SOUNDERS IN THE ATMOSPHERIC BOUNDARY LAYER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 685-695
manuscript received 2 Mar 79

ARMAND, N. A., ANDRIANOV, V. A., ALEKSANDROV, A. L., VETROV, V. I. and
SHUBA, V. D.

[Abstract] Field studies of various components and of the performance of entire acoustic echo sounders were conducted in summer on a fair day at $10-20^\circ \text{ C}$. Measurements of the level and spectral characteristics of noise were performed. Several different techniques of reducing noise are named. The components of the acoustic echo sounder (AES) and of its antenna system are named and described. In particular, the acoustic antenna of the AES used incorporates a parabolic glass reflector 20 mm thick, at the focus of which is located an electroacoustic transducer with a rated power of 50 watt. A formula for the reflector-caused amplification of sound pressure is presented. The antenna system thus developed serves to carry out vertical sounding of the boundary atmospheric

layer. The electronic part of the AES contains sounding-pulse shapers, amplifiers of emitted and received signals, and devices for processing and recording the diffused sound signal. In particular, the received signal is tape-recorded with the object of its subsequent amplitude and frequency processing. Such automation of measurements yields operative data on the measured variables. Prolonged observations with the aid of the described AES make it possible to observe variations in physical processes and meteorological characteristics of the boundary atmospheric layer. The author thanks A. V. Sokolov and V. M. Polyakov for assistance during creation of the acoustic echo sounder, and M. A. Kolosov for support of the work. Figures 7; references 7: 4 Russian; 3 Western.
[259-1386]

UDC 538.56:538.221

AN ELECTROMAGNETIC WAVE IN A FERROMAGNETIC PLATE

Moscow ELEKTRICHESTVO in Russian No 5, May 80 pp 71-72 manuscript
received 26 Mar 79

KUBALDIN, A. B., candidate of technical sciences, and SAL'NIKOVA, I. P.,
engineer, Moscow

[Abstract] Calculating the electrical parameters of a ferromagnetic plate is a common problem in the design of induction equipment for heating various steel products. The problem reduces to a second-order nonlinear differential equation for the magnetic field distribution in a plate of any thickness and with a uniform temperature distribution. Here this equation is solved for plates of small thicknesses, comparable with the depth of field penetration, by conversion to an equation in finite differences. Numerical results have been obtained with the aid of a Nairi-2 digital computer by the methods of elimination and iteration, the depth of penetration having been defined as the thickness of an infinitely large plane layer which dissipate 86 percent of the entire absorbed power. The results are presented in the form of curves convenient for design and evaluation. This method of solution is more accurate than the analytical one with an infinitely thick plate as the starting point and with an analytic expression for the magnetic permeability. Figures 5; references: 5 Russian.
[272-2415]

UDC 538.576.23

ONE METHOD OF TESTING THE "FROZEN" TURBULENCE HYPOTHESIS FOR RANDOMLY
NONHOMOGENEOUS TRANSPARENT MEDIA

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 570-575
manuscript received 11 Jun 79

ZVEREV, V. A., KRIKUNOVA, E.M. and MARKUS, F. A., Gorkiy State University

[Abstract] The "frozen" turbulence hypothesis allows experimental studied of a turbulent medium and radiation propagating through it to proceed by measurement of their time characteristics and then correlation of the latter with their space characteristics. In the present paper this hypothesis is tested for a randomly nonhomogeneous medium by also considering the alternative model of "completely unfrozen" turbulence. Both models are substantiated theoretically and a practical experiment is performed with both, a rotating disk in the form of a transparent base covered with opaque spots of random shapes and sizes providing the "frozen" turbulence

model. An analysis of the light intensity distribution in a focal plane indicates in a simple manner whether one or the other model is valid, i.e., an irregular medium moves as an entity or as such does not move at all. Figures 3; references 3: 2 Russian; 1 Western in translation. [273-2415]

UDC 621.372.414

TEMPERATURE STABILITY OF THE FREQUENCY OF DIELECTRIC RESONATORS WITH THE H-MODE OF OSCILLATIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 856-858
manuscript received 28 Sep 78

CHERNIY, B. S.

[Abstract] The temperature coefficient of frequency (TCF) of the oscillation mode of dielectric resonators (DR) and its dependence on the DR parameters and the properties of the dielectric material (temperature coefficients of permittivity TK_ϵ and linear expansion TK_L) have so far been relatively uninvestigated. Yet temperature affects the resonance frequencies of the natural oscillations of DR. Hence the analytic dependence of the overall TCF on the parameters of a cylindrical DR was investigated on proceeding from the characteristic equations of the model of an unperturbed DR. The possibility of thermal compensation of frequency for DR made of dielectrics with negative TK_ϵ is established; the attendant overall TCF is much lower than the TK_ϵ and TK_L of the dielectric. A corresponding formula is presented. The relations derived are of practical interest because they may be used to determine the TK_ϵ of dielectrics by the method of the resonance excitation of electromagnetic oscillations in the investigated dielectric specimens representing DR. The then obtained values of TK_ϵ can be subsequently used to compute the temperature stability of the oscillatory systems of solid-state generators and microband selector devices based on DR. Figures 1; tables; references 4: 3 Russian; 1 Western. [259-1386]

DEPENDENCE OF THE CROSS SECTION FOR BACKSCATTERING BY A NONHOMOGENEOUS PLASMA CYLINDER WITH A LARGE RADIUS ON THE POLARIZATION OF THE INCIDENT FIELD

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 626-628
manuscript received 19 Jun 79

KUVAYEV, V. M. and PERMYAKOV, V. A., Moscow Institute of Power Engineering

[Abstract] A plasma cylinder is considered with a large-scale smooth radial nonhomogeneity and with a large radius of the supercritical plasma region. The more intensive backscattering by it of an incident H-wave than of a E-wave is explained by calculations according to the quasi-optics theory, the geometrical-optics approximation being quite accurate for an E-wave but not so for an H-wave. The authors thank V. K. POLISHCHUK and I. G. YAKUSHKIN for the interest and the helpful discussions. Figures 1; references 8: 6 Russian; 2 Western.
[273-2415]

GENERATION AND AMPLIFICATION OF ELECTROMAGNETIC WAVES BY RECTILINEAR RELATIVISTIC ELECTRON FLUXES IN AN INHOMOGENEOUS MAGNETIC FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 815-822
manuscript received 19 Jul 79

KURAYEV, A. A. and SHESTAKOVICH, V. P.

[Abstract] The recent advances in heavy-current relativistic injectors have prompted intensified research into the possibility of generating and amplifying and multiplying the frequency of electromagnetic waves by means of relativistic electron fluxes (REF). Thus the development of new mechanisms of interaction of REF with intense electromagnetic fields acquires major importance. In this connection a mechanism of energy exchange between a rectilinear REF and rotating $H_{\perp n}$ fields in an inhomogeneous magnetic field is considered: in this case, the magnetostatic conversion of the drift energy of electrons becomes essential. It is shown that, when the magnetic field is of optimal shape, such a mechanism assures nearly total transfer of REF energy to the electromagnetic field. The optimal processes of interaction of REF with $H_{\perp n}$ fields are investigated for two variants of rectilinear-REF generators and two variants of amplifiers. It is shown that a practical and effective modulator design is possible only in the presence of a small number of inhomogeneity periods of the magnetic field and at a sufficiently high amplitude of the inhomogeneity. Figures 4; tables 1; references 12: 6 Russian; 6 Western.
[259-1386]

FEATURES OF FLICKER NOISE CONVERSION IN A MODIFIED DIODE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 881-884
manuscript received 25 Sep 78

DEVYATKOV, M. N., OVCHINNIKOVA, G. I. and TARASOV, A. V.

[Abstract] Low-frequency noise caused by the flicker effect is of interest in the utilization of modified-diode systems for the detection or mixing of signals. Aspects of the space-charge conversion of noise of this kind in a modified diode are investigated in the present communication. Because the conversion of flicker noise by means of a space charge is a function of the coefficient of suppression Γ , the corresponding formulas are analyzed and it is shown that Γ can be both below and above zero in modified diodes, whereas in conventional diodes it is always positive. Experimental measurements of flicker noise in two tetrode-type devices show that in the presence of low negative anode potentials, in the exponential part of the volt-ampere characteristic (delay mode), noise increases with increase in current, but with transition to the mode in which there exists a space-charge constraint on current intensity, noise decreases and reaches a minimum, followed by an increase in noise once the mode of unhindered current passage is reached. These experimental findings are found to be in agreement with theory. Moreover, the pattern of behavior of noise thus observed is found qualitatively to correspond to the pattern of fluctuation of the coefficient of suppression. These findings represent the first direct experimental corroboration of two theories: the theory of the existence of modes characterized by both suppression and intensification of noise, ($\Gamma < 1$ and $\Gamma > 1$) and the theory of the existence of conditions (in the neighborhood of transition from the current-constraint mode to the delay mode) at which a minimum of low-frequency noise, corresponding to $\Gamma = 0$, is observed, Figures 2; references: 6 Russian, [259-1386]

DYNAMICS OF TWO-DIMENSIONAL PHASE FOCUSING IN O-TYPE TRAVELING WAVE TUBES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 807-814
manuscript received 28 May 79

MAN'KIN, I. A. and USHEROVICH, B. L.

[Abstract] On the basis of a previous study of a two-dimensional model with a large number (~ 500) of large particles, it has been possible, during research into dynamic two-dimensional effects in O-type traveling-wave tubes (OTWT), to analyze the phase patterns of the particles in

the coordinates radius-phase and thus to determine the process of the formation of bunches and their deformation along the length of the system. However, this information is insufficient for a detailed analysis of the processes of two-dimensional phase focusing, because it does not make it possible to determine the direction of motion and energy of discrete particles. To fill this gap, these factors are now taken into account by revising the corresponding program for the case of the interaction of axisymmetric fluxes with the wave in OTWT. It is shown that the dynamics of two-dimensional phase focusing in OTWT are characterized by four basic stages: 1) The formation of the primary bunch; 2) The dissolution of the bunch; 3) The formation of a large secondary bunch; and 4) The presence of an extremely broad flux of accelerated electrons traveling from the secondary toward the primary bunch. It is also found that in high-amplification TWT flux structure is a factor only in the linear and quasilinear sectors. On transition to nonlinear mode (past the current maximum) the flux undergoes complete "mixing" and becomes so chaotic as to have nothing in common with its original structure. Figures 4; references: 12 Russian. [259-1386]

UDC 621.385.63.01

THEORETICAL ANALYSIS OF THE INTERACTION OF TWO SIGNALS WITHIN A BROAD FREQUENCY BAND IN TRAVELING-WAVE TUBES

Moscow RADKOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 792-800
manuscript received 14 Jun 78

ALGAZINOV, E. K. and MYMRIKOVA, N. N.

[Abstract] This analysis of signal interaction in traveling-wavetubes (TWT) is based on a new approach which consists in partitioning the tube interaction space into K identical sectors and considering separately for each sector the interaction of a pre-modulated (owing to passage across preceding sectors) electron beam and the electromagnetic field. Recurrence formulas linking the expansion coefficients (which characterize the modulation and the transit angle) of any two adjoining sectors are derived. Other derived formulas serve to compute the intensity and phase ratios of output spectra for any ratio between the frequencies and input power of the signals. The case of a TWT-amplified two-frequency signal with a markedly nonuniform distribution of power between its components, as considered by way of an example, conclusively demonstrates the potential of this method for research into the effect of various signal and amplifier parameters on multifrequency processes in TWT. Figures 4; references: 10 Russian. [259-1386]

CALCULATIONS OF THE OUTPUT SIGNAL SPECTRUM OF TRAVELING-WAVE TUBES
ACCORDING TO SPECIFIED INPUT SPECTRUM

Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian No 4, 1980 pp 801-806
manuscript received 19 Dec 78

BELYAVSKIY, Ye. D. and GEL'NER, V. V.

[Abstract.] It is known that the shape of the envelope and the spectrum of the output signal of a traveling-wave tube (TWT) can be determined as a function of the specified shape of the input signal envelope. In practice, however, it is often more expedient to determine the TWT output signal spectrum as a function of a known input signal spectrum. In this connection, a corresponding computational procedure is proposed for the nonlinear mode. An equation describing the system field at the z -point on the TWT axis is used to derive corresponding recurrence relations applicable to any type of modulation of the input signal. On this basis, particular cases, such as phase modulation of an input signal, amplitude modulation, and a case in which the input signal spectrum represents a uniform spectral density distribution within some frequency band, are analyzed. It is shown that nonlinear frequency distortions change upon transition from the maximum amplification mode to the maximum efficiency mode. Figures 4; references: 3 Russian.
[259-1386]

UDC 656.254.16:621.396.96:531.767

THE DIS-74 DOPPLER VELOCITY METER

Moscow AVTOMATIKA, TELEMEXHANIKA, SVYAZ' in Russian No 4, 1980 pp 21-22

YEFIMOV, L. L., chief project engineer of Giprotranssignalsvyaz' Institute, KRONOV, V. N., chief specialist, and PRUDOVSKIY, I. I., group director

[Abstract] The paper describes the new DIS-74 velocity meter developed at the Giprotranssignalsvyaz' Institute. A plant-tested experimental model of the device is in operation in the ARS-GTSS automatic system for sorting rolling stock in the marshalling yard of the Leningrad-Moscow Sorting Station. The meter uses the Doppler effect, which operates as follows. As the car (coupling) shifts relative to the stationary meter, the frequency of the signal sensed by the receiver differs from the frequency F_0 emitted by the transmitter by an amount F_D proportional to the velocity of the car. The value of F_D is given by the formula $F_D = \frac{2|V|}{\lambda} \cos Y$, where $|V|$ is the speed, λ is the wavelength of the emitted signal, and Y is the angle between the direction of motion and the emission maximum. The unit measures velocities from 3 to 30 km/hr at a distance of up to 50 m. Signal wavelength is 3.2 cm at a power of at least 25 mW. The device contains rf and low-frequency modules. The rf module generates a microwave signal, radiates this signal into space, and receives the signals reflected from the rolling stock, converting them to low-frequency Doppler signals. The low-frequency module converts line voltage on 50 or 400 Hz to constant stabilized voltage for power supply to the electronic components of the rf module. The module can handle variations in line voltage from -15 to +10%. In 1978, the Institute developed the DIS-77 velocity meter for checking the speed of ships in locks. This unit is the first to use a Soviet semiconductor Gunn-diode oscillator. In this meter, the Doppler signal is converted to both digital and analog form. Figures 1.

[262-6610]

UDC 539.216.2.001.5

EXCESS NOISE IN THIN ALUMINUM FILMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 771-780
manuscript received 7 Jul 78

ZHIGAL'SKIY, G. P. and BAKSHI, I. S.

[Abstract] The effect of structural microdefects on noise of the $1/f$ type (which may also be termed excess noise) in aluminum--a metal widely used in microelectronics--is investigated as a function of temperature and deformation. To this end, specimens of vapor deposited aluminum film (99.99% pure aluminum), 100 ± 10 nm thick, deposited on glass-slide substrates were experimentally annealed at low temperatures (150-500 K). The spectral density of the excess noise was measured with the aid of a S5-3 spectral analyzer and a V3-5 voltmeter. Internal mechanical stresses were determined by bending tests with the aid of a simple optical system. A temperature-dependent component of excess noise was discovered within the 200-460 K range. Further, it was found that in films with a higher concentration of inequilibrium vacancies the level of excess noise is higher, while the annealing-caused relaxation of the concentration of vacancies results in an irreversible decrease in the noise. Given a constant temperature, an increase in tensile stresses results in an increase in the vacancy concentration and hence also in an increase in excess noise. Thus the excess noise level is a function of the concentration and mobility of the vacancies. In general, an increase in temperature or the application of tensile stresses facilitates the process of the diffusion (and hence also relaxation) of vacancies. Thus the effect of microdefects on excess noise in metal thin films has been experimentally confirmed. The authors thank A. I. Otrezov for making measurements of the internal mechanical stresses in films on glass substrates. Figures 5; references 17: 13 Russian, 4 Western (1 in translation).
[259-1386]

MICROELECTRONICS: CURRENT STATE OF DEVELOPMENT

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 80 pp 20-25 manuscript received 21 Dec 79

VASENKOV, A. A., YEFIMOV, I. Ye. and SRKTENSKIY, V. N.

[Abstract] This is an overview type article devoted to contemporary developments and the potentials of microelectronics, radioengineering and communications. In electronics there are two principal areas of fast advance: information and energy. The exponential growth of radio electronics equipment led to the transition from vacuum tubes to semi-conductors and integral circuits. The most promising development in microelectronics is represented by microprocessors which can store memories of 2-32 bits in single crystals and perform operations in 10 to 0.1 micro-second. Predictions have been made for continued growth in the application of microelectronics to communication networks. Along with traditional electronics, rapid growth is projected for opto-, acusto-, magneto- and cryoelectronics. Figures 2, references 17: 16 Russian, 1 Western. [261-7813]

UDC 621.315.592

THE RADIATION RESISTANCE OF INTEGRATED MICROCIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 195-201 manuscript received 8 Aug 79

AGAKHANYAN, T. M., ASTVATSATUR'YAN, Ye. R., SKOROBOGATOV, P. K. and CHUMAYOV, A. I.

[Abstract] A review is presented of the physical effects which occur when integrated microcircuits are exposed to ionizing radiation, including volumetric, surface and ionization effects. An equivalent circuit of a p-n junction is constructed considering the effects of ionizing radiation. The influence of radiation on the efficiency of microcircuits is studied for bipolar and MOS structures. An equivalent circuit of a MOS element considering ionization currents is presented. This is the most resistant type of microcircuit when made of silicon on a sapphire substrate. The thinness of the silicon layer and resultant small active volume of the device allows instruments to be created which can operate reliably at up to $\dot{\gamma} = 10^{10} - 10^{11}$ rad/s. MOS microcircuits are also insensitive to volumetric structural damage, but quite sensitive to changes in surface properties. Figures 5; references 24: 7 Russian, 17 Western. [253-6508]

BASIC METHODS FOR THE FORMATION OF THIN-FILM STRUCTURES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, 1980 pp 39-43

VLADIMIRSKIY, R. A., candidate of physicomathematical sciences, GIMPEL'SON, V. D., BYKOVA, L. V. and IL'ICHEVA, O. I., engineers

[Abstract] Thin-film technology is the basic technology for preparation of special-application hybrid circuits and microassemblies for precision instrument building. Construction of a thin-film microassembly depends on the number of superimposed layers and on the materials being used. Monolayer structures include resistors, conductors and possibly capacitors. Multilayer structures possess at least two layer rectifiers and insulation at the crossing points. Various methods for the formation of monolayer and multilayer structures are reviewed in table form. Their advantages and complexity are noted. In addition to the basic method, a number of auxiliary formation methods are listed. A section is devoted to the formation of designs on thin films. One of the main advantages of thin-film technology is its adaptability to the specific needs and the ability to select materials best suited for a given task and to shape them into any desired configuration. Figures 1; tables 2.

[257-7813]

UDC 621.375.147.2:621.317

TECHNOLOGY OF THIN-FILM MICROASSEMBLIES FOR COMPLEX MODULAR MEANS OF ELECTROMEASURING TECHNIQUES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, 1980 pp 38-39

ABAKUMOVA, I.A., NOVIKOVA, S.M., engineers and TAMBERG, Yu. G., candidate of technical sciences

[Abstract] Modular means of electromeasuring techniques (ASET) necessitate development of microassemblies for specific application, which most often can be achieved through thin-film technology. Some of these requirements are: high precision thin-film resistors and a wide range of sensitivity. Data on these resistors are shown in tabular form. Currently the All-Union Association "Soyuzelektropribor" [Electrical Devices Union] has developed and series manufactured more than 50 types of thin-film analog microassemblies. They include high-quality operational amplifiers, stabilizers, colorimeters and analog multiplication-division circuits. Specific quality control and production steps in the manufacture of microassemblies are discussed with suggestions for preferred methods of advanced technology. Tables 3; references: 2 Russian.

[257-7813]

THE OPERATION OF MDPN SWITCHES AS A PULSED ACTIVE LINE

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 249-252
manuscript received 14 Oct 79

MALAKHOV, B. A.

[Abstract] An experimental study is made of metal-tunnel-transparent dielectric-p-n (MDPN) junctions. Specimens were prepared by a technology which produces a distance between the closest edges of metal electrodes of 50-400 micrometer. The thickness of the dielectric layer is 1.7-2.6 nm. A bias was fed to one of the MDPN diodes which was insufficient to cause it to switch, after which the second MDPN diode was switched, causing the first diode to switch. If there is a chain of such diodes, switching can thus be transmitted along the chain. The paper studies the interactions of pairs of neighboring diodes under these conditions. Characteristics studied include the delay time between switching of the first and second diodes. It is found that switching of the first diode may occur even if its bias current has been removed before switching of the second diode occurs. Possible explanations of these phenomena are studied. The author thanks M. I. Yelinson, V. I. Pokalyakin and I. L. Beynikhes for helpful discussions in the course of the work. Figures 3; references 8: 1 Russian, 7 Western.
[253-6508]

UDC 621.311.019.3.001.24

STABILITY OF SOLUTIONS TO PROBLEMS IN RELIABILITY THEORY

Moscow ELEKTRICHESTVO in Russian No 5, May 80 pp 12-15 manuscript received
10 Jul 79

FARKHADZADE, E. M., candidate of technical sciences, and MAMED-VELIYEV,
V. K., engineer, Baku

[Abstract] The stability of solutions to reliability problems is analyzed in the case where selection of a system design variant must be made on the basis of estimated necessary distributions and input data. The analysis is applied specifically to design and operation of power systems with budgetary constraints, a relation being established in numerical terms between the outcome of a variant selection and reliability indicators of system elements. As the basis for the variant selection serves the criterion of not exceeding a certain failure probability at a minimum limped cost, with a higher system reliability assumed to be attainable only at a higher cost. The results of this analysis indicate a high probability of erroneous solution based on point estimates of the reliability indicators of system elements. It is preferable to use estimates based, with given confidence coefficients, on catalog values. Then, with a confidence coefficient $P = 0.9$, the probability of selecting an unreliable system variant becomes much lower. With $P \geq 0.95$ this probability decreases still further to a few percent, although the anyway low probability of a correct solution also decreases. The choice between using point estimates or guaranteed catalog values thus depends on the selection of appropriate confidence coefficients. Tables 2; references 6: 5 Russian; 1 Western (translated into Russian).

[272-2415]

UDC 621.373.5

AUTODYNE AND MODULATION CHARACTERISTICS OF SEMICONDUCTOR INJECTION LASERS

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 533-541
manuscript received 2 Mar 79

GERSHENZON, Ye. M., TUMANOV, B. N. and LEVIT, B. I., Nizhniy Tagil State Pedagogical Institute

[Abstract] Autodyne laser systems include a third mirror forming an external resonator cavity. Here the performance parameters of semiconductor injection lasers (IPL) in such systems, namely their autodyne gain and modulation capability as well as the power-current characteristic, are determined on the basis of both theoretical analysis and experimental data. The fundamental equations of emission dynamics include the effect of spontaneous emission and the effect of reflected radiation, the latter having been found to modulate the Q-factor under load and the natural resonator frequency. Variation of the pumping rate is also taken into account. Experiments were performed with heterostructure injection lasers, an audio oscillator and a current stabilizer. The results together with the theoretical relations yield the maximum autodyne gain and the maximum modulation capability at Doppler frequencies much lower than the frequency of relaxation oscillations, both occurring approximately at the same injection current near the emission threshold and both limited by spontaneous emission. Figures 4; references 25: 14 Russian; 11 Western. [273-2415]

UDC 621.378.325

CHARACTERISTICS OF A GIANT PULSE EVOLVING FROM FREE EMISSION

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 542-546
manuscript received 8 Feb 79

BAKHORIN, V. A., YEPIFANOV, Yu. N. and MARKIN, A. S., Moscow Institute of Radio Engineering, Electronics and Automation

[Abstract] Instability of the time at which a giant pulse evolves from free emission in a laser with active Q-factor modulation is analyzed, and the shutter timing is determined at which the energy of an emitted giant pulse exceeds by far the energy of the preceding free emission. The calculations are based on the kinetic equation according to Staats-de-Mars, from which an expression is derived for the ratio of giant pulse energy to free emission energy, and experimental data in the form of oscillograms of emission current through a shutter from a neodymium traveling-wave ring laser. Figures 2; references: 2 Russian. [273-2415]

SOUND REPRODUCTION EQUIPMENT - 80

Moscow RADIO in Russian No 3, 1980 pp 39-42

KONOKOTIN, Yu, Moscow

[Abstract] During the 10th Five-Year Plan considerable growth was noted in the area of sound reproduction equipment. Basic technical characteristics of such equipment are tabulated and analyzed in this article. The compilation includes data on record players, electrophones, stereo systems, speakers and amplifiers. Tables 3.

[263-7813]

UDC 539.2:548.25

THE STRUCTURE AND DEGREE OF HOMOGENEITY OF $\text{Ge}_x\text{Si}_{1-x}$ FILMS OBTAINED BY SOLID-PHASE EPITAXY ON Si

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 269-273
manuscript received 20 Jul 79

KRYUGER, D. B. and MIKHAYLOV, I. F.

[Abstract] A new method was recently suggested for producing $\text{Ge}_x\text{Si}_{1-x}$ films by solid-phase epitaxy. This article studies the degree of homogeneity of films produced by this method. Three basic problems are studied: phase heterogeneity, the presence of inclusions of germanium or silicon phases; macroheterogeneity of the solid solution, a variation in the concentration of Ge or Si averaged over an area of about 1 square millimeter; and microheterogeneity of the solid solution, with differences in the concentration of Ge or Si in different blocks - areas of coherent scattering. The method of solid phase epitaxy on (111) and (100) Si substrates produces homogeneous submicron epitaxial layers of a solid solution of $\text{Ge}_x\text{Si}_{1-x}$ with small variations in thickness and chemical composition over an area of several cm^2 . The microheterogeneities are within $5 \cdot 10^{-4}$ - $3 \cdot 10^{-3}$ and are explained by differences in microareas of the epitaxial layer in terms of composition and microheterogeneity of the residual stresses. The latter is apparently dominant. Figures 2; references 6: 4 Russian, 2 Western.
[253-6508]

UDC 539.216.22.538.61

ELECTRIC CONTROL OF MAGNETOOPTIC ABSORPTION IN SEMICONDUCTOR FILMS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 264-268
manuscript received 25 Jul 79

ZAYTSEV, V. Ye., RZHANOV, A. Ye., RYZHIY, V. I. and RYABOVA, N. L.

[Abstract] A study is made of the modulation of radiation in semiconductor films in relatively weak magnetic fields with control by an electric field directed perpendicularly to the magnetic field. A film of a semiconductor in crossed electric and magnetic fields is thus studied. The application of an electric field with no magnetic field present practically does not change the position and shape of the edges of absorption; however, when a magnetic field of comparatively low intensity is present, a perpendicular electric field leads to a significant change in the position of the edge of absorption with some blurring of the edge. The nonmonotonic variation of transmission in the magnetic field as a

function of photon energy indicates that in this case, in spite of the low intensity of the magnetic field, the combined density of states as a function of energy does have a minimum. The blurring of the edges of absorption in the electric field can be explained by an increase in collision attenuation under the influence of the electric field. The authors are grateful to S. G. Kalenkov for useful remarks. Figures 5; references 6: 4 Russian; 2 Western.
[253-6508]

UDC 548.316

STUDY OF DEFECTS IN EPITAXIAL STRUCTURES (ES) OF SILICON ARISING IN THE PROCESS OF HEAT TREATMENT BY THE METHOD OF ANNIHILATION OF POSITRONS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 282-284
manuscript received 10 Sep 79

BATAVIN, V. V., DRUZHKOVA, A. P., GARNAK, A. Ye., MOKRUSHIN, A. D.,
PROKOP'YEV, Ye. P. and KHASHIMOV, F. R.

[Abstract] The following tasks were performed: the correlation curves of annihilation quanta in epitaxial structures of silicon on silicon were measured. The measurements were performed on an installation with parallel-slit geometry with a resolution of 0.9 mrad. Points on the curve were measured each 0.5 mrad. The statistical error in the area of small angles was 1.5%. The β^+ -radioactive isotope ^{22}Na was used as a source of positrons. The data produced are interpreted by analysis of the kinetics of the process of annihilation of positrons in the area of a single-crystal substrate adjacent to the epitaxial film. The method of annihilation of positrons can be used to study defects in epitaxial layers and, possibly, Si-based LSI circuits and for non-destructive industrial quality assurance. The authors thank Yu. N. Kuznetsov, V. G. Nosov and V. L. Sedov for discussions. Tables 1; references 10: 8 Russian; 2 Western.
[253-6508]

DESIGN OF THYRISTORS FOR A DIRECT FREQUENCY CONVERTER

Moscow ELEKTRICHESTVO in Russian No 5, May 80 pp 31-36 manuscript received 1 Jun 79

ZHEMEROV, G. G., candidate of technical sciences, and KOVALENKO, I. T., engineer, Kharkov

[Abstract] A graphoanalytical method of calculations is presented for determining the performance parameters of a frequency converter in a given operating mode and the permissible peak temperature rise in the p-n-p-n thyristor junction. This method is specifically applied to a 6-phase bridge and a phase shifter with an inverse-sine characteristic which delivers a sinusoidal control voltage, assuming a sinusoidal load current and instantaneous current commutation. The ratio of input (line) frequency to converter output frequency is the basic parameter for which the performance parameters are calculated as functions of the stipulated peak temperature rise, and then the power losses during one repeatable period are plotted. The actual peak temperature rise is calculated from the differential equation describing the thermal model of the thyristor. The procedure is repeated, if necessary, until the calculated peak temperature rise comes within 0.5% of the initially stipulated one. The calculations are aided by a table of coefficients and illustrated by curves of maximum permissible load current as a function of the frequency as well as of the angle for T-160, T2-320 and T3-320 devices. Figures 5; tables 2; references: 4 Russian. [272-2415]

UDC 621.317.353

PARAMETRIC STEP-UP FREQUENCY CONVERSION IN SUPERLATTICES

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 617-625 manuscript received 23 Apr 79

ROMANOV, Yu. A., Physico-Technical Scientific-Research Institute affiliated with Gorkiy University

[Abstract] Semiconductor superlattices are nonlinear media even in relatively weak electric fields, while domains of negative conductance appear under strong alternating electric fields. Here odd-function nonlinearity of such a superlattice is considered as the mechanism of degenerate parametric amplification of an even (second) harmonic, by merger and split of $2n_0$ pump quanta, and parametric generation of an odd (third) harmonic with its subsequent amplification. Special cases include matched phase

velocities and "linear" amplification with self-transparency or with exact synchronism. The author thanks A. M. BELYANTSEV and L. A. OSTROVSKIY for helpful comments. Figures 1; references 6: 5 Russian; 1 Western. [273-2415]

UDC 621.372.029.64

EXPERIMENTAL INVESTIGATIONS OF AMPLITUDE NOISE IN GUNN DIODES IN THE NEIGHBORHOOD OF THE CARRIER FREQUENCY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, 1980 pp 884-886
manuscript received 27 Feb 78

KUDABA, V. Ye. and UNDZENAS, V. I.

[Abstract] As a rule, in Gunn diodes amplitude noise near the carrier frequency is measured only from 1 kHz upward. In this connection, it was of interest to investigate the amplitude noise at from 10^{-3} Hz to 1 MHz in the neighborhood of the carrier frequency. The investigation was performed in the centimeter range of GaAs Gunn diodes which were connected to a segment of a rectangular waveguide, parallel to one of the narrow walls of the waveguide. On its one side, the waveguide was under a shorting-device load, and on its other, a microwave signal, modulated by amplitude noise, entered a low-noise crystal detector. Such an arrangement assured substantial output voltage, of the order of one volt, needed for a reliable performance of the crystal detector. The amplitude distribution, correlation function, and spectrum of the noise were measured. It was found that at low frequencies on the order of fractions of a Hz, the noise spectrum tends toward saturation, with a pattern similar to that of generative-recombinative noise. At frequencies of the order of ≥ 1 Hz the spectral density of the noise increases by a factor of several tens, and noise of the f^{-1} type arises, particularly when high voltages of the order of several volts are applied to the diode. Thus the spectrum of amplitude noise is characterized chiefly by noise of the f^{-1} type. Measurements of the spectrum of noise arising in the specimen's d-c circuit revealed a similar pattern. Figures 4; references 3: 1 Russian; 2 Western. [259-1386]

TECHNICAL FLUCTUATIONS IN A BARITT-DIODE OSCILLATOR

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 585-593
manuscript received 10 May 79

ZAYTSEV, V. V., ORLOV, V. B. and YAKIMOV, A. V., Gorkiy State University

[Abstract] Flicker in a BARITT diode with a p^+-n-p^+ structure is analyzed on the basis of a one-dimensional model, where the active length of the n-region including an injection zone and a drift zone is much smaller than the width of the device. Fluctuations of this active length are assumed to be due to diffusion of acceptors from a p^+ -region to the n-region and diffusion of impurity atoms from the surface only, with instability of the supply voltage also taken into account. From the d.c. characteristics of such a diode, in the simple case of low injection levels and thus a negligible space charge in the drift zone, the spectral characteristics of amplitude and frequency fluctuations in the oscillator output signal are calculated. These fluctuations are found to be caused mainly by random perturbations of the barrier location which results in fluctuations of the transit time. Only rough numerical estimates are obtained in the present paper, more precise ones requiring a further refinement of the dynamic model. Figures 1; references 10: 6 Russian; 4 Western.

[273-2415]

STUDIES OF THE ELECTROPHYSICAL PROPERTIES OF METAL-OXIDE SEMICONDUCTOR STRUCTURES BASED ON n^- AND $p\text{-Hg}_{1-x}\text{Cd}_x\text{Te}$

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 274-276
manuscript received 27 Jun 79

ANTONOV, V. V., VOYTSEKHOVSKIY, A. V., KAZAK, Ye. P. LANSKAYA, O. G.
and PETROV, A. S.

[Abstract] The C-V curves of MOS structures are presented, produced by anodization of specimens of n- and $p\text{-Hg}_{1-x}\text{Cd}_x\text{Te}$. The initial specimens, 200-400 μm thick, were chemically and mechanically polished and etched. The field electrode was applied by vaporizing aluminum. The C-V curves were measured at 77 K at frequencies of 5 kHz to 5 MHz. The method of anodization of specimens with chemical and mechanical working of the surface is found to produce MOS structures with "high frequency" C-V curves and moderate density of surface states. Figures 3; references 6: 1 Russian; 5 Western.

[253-6508]

MASS TRANSFER OF VARIOUS METALS ON THE SURFACE OF SILICON AND GERMANIUM LEADING TO SWITCHING OF CURRENTS AND ENERGY-INDEPENDENT MEMORY

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 3, May/Jun 80 pp 276-277
manuscript received 14 Nov 79

MUKAILOV, N. S., STEPANOV, G. V. and SHEVCHENKO, O. F.

[Abstract] A study is presented of pole-dependent mass transfer of various metals over the surface of a semiconductor. The specimens were plates of single-crystal Si or Ge with chemically pure metals evaporated onto the surface under a vacuum. The experiments were performed on plates of single-crystal Si or Ge with chemically pure metals evaporated onto the surface under a vacuum. The experiments were performed on plates of n-Si with an initial specific impedance of 1, 2.5 or 10 ohm-cm. When a pulsed voltage (rectangular or semisinusoidal shape) was applied to the metal contacts a metal filament extended from one electrode to the other, closing the interelectrode gap. The appearance of the filaments was observed visually under an optical microscope and by measurement of volt-ampere characteristics. Analysis of the experimental results shows that there is a possible relationship between pole-dependent mass transfer of metal over the surface of a semiconductor and the melting point of the metal. Figures 1; tables 1; references: 2 Russian.
[253-6508]

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GUNN-EFFECT BISTABLE SWITCHES

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BRCHE, M. A., KOZLOV, A. T., KRAVCHENKO, L. N., PASHINTSEV, Yu. I.,
SAPEL'NIKOV, A. N., STAROSSEL'SKIY, V. I. and TRANCHENKO, V. D.

[Abstract] In Gunn diodes with a sufficiently high concentration of the doping element, the strong electrical field domain may persist in the neighborhood of the anode. In the presence of below-threshold voltages the diode may exist in two stable states, one characterized by a uniform distribution of the electrical field along the diode length and the other, by the presence of the strong field domain in the neighborhood of the anode. In this connection the parameters required for the anode region in order to attain such a bistable mode were investigated by simulating the Gunn device with the aid of a computer, on using a field model in

which electron mobility μ is a function of mean power P . On this basis, the boundary conditions at the anode and cathode contacts are formulated, for Gunn devices of the expanding-anode and n^+ -anode types, and it is found that generation of the strong field domain requires a more drastic reduction in current density in the neighborhood of the expanding anode. Experiments with planar Gunn diodes based on epitaxial films of n-type gallium arsenide grown on semi-insulating substrates showed that the required reduction in current density can be assured by sharply enlarging the near-anode region and creating additional contacts, so that the current density is then reduced in half over a distance of not more than 5-10 micrometer. The distribution of electrical potential along the diode length indicates that the bistable mode in devices of this kind is caused by the formation of a strong field domain in the neighborhood of the anode. Figures 5; references 18: 2 Russian; 16 Western.
[259-1386]

UDC 621.382.029.64

GENERATION OF SHORT HIGH-POWER PULSES WITH THE AID OF THE GUNN DIODE

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STAROSSEL'SKIY, V. I.

[Abstract] While the Gunn diode serves to generate pulses 10^{-10} - $5 \cdot 10^{-9}$ sec duration, of near-rectangular shape, there exist physical constraints on the amplitude of the voltage pulses thus generated. In this connection the maximum possible pulse amplitude was investigated, and the constraints limiting it were elucidated. It is shown that an increase in the pulse amplitude requires increasing the strong-field domain voltage, but this in its turn is limited by the shock ionization in the domain, which occurs once the field reaches a certain critical value. A formula is presented for the maximum pulse amplitude in highly doped Gunn diodes, in which the domain fields are large and domain width is comparatively small. The maximum pulse amplitude is formulated as a function of the electron concentration in the Gunn diode and of the diode length. Other formulas presented serve to design Gunn diodes generating maximum-amplitude pulses of specified duration. Figures 2; references 6: 1 Russian; 5 Western.
[259-1386]

EXPERIMENTAL INVESTIGATION OF A MICROWAVE-RANGE GaAs-TYPE MIXER OPERATING IN THE SUBTHRESHOLD MODE

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LEVTEROV, A. N., MALYSHEV, V. A. and RADCHENKO, A. F.

[Abstract] Frequency conversion with the aid of an external heterodyne, as based on the use of the nonlinear bulk properties of n-GaAs specimens at fixed subthreshold voltages was experimentally investigated. The mixer in the experiments operated within the frequency range of $2.58 \cdot 10^{10}$ to $3.7 \cdot 10^{10}$ Hz. A marked frequency conversion was observed beginning with voltages of 0.3 of the threshold voltage, which approximately corresponds to a field intensity of ≈ 1.7 kw/cm. At such a voltage the bulk conductivity of GaAs at frequencies of about 35 GHz is of a nonlinear nature. The noise coefficient of the GaAs-type mixer in the subthreshold mode was found to be similar to that of Schottky-barrier diode-type mixers, and the GaAs-type mixer itself displays certain advantages (lower noise coefficient, broader dynamic range) over the autodyne mixer. Moreover, while Schottky-barrier diode-type mixers display a better noise coefficient (about 5 dB) within the 20-50 GHz range, GaAs-type mixers can be recommended as effective microwave-range frequency converters at frequencies exceeding 30 GHz. Figures 2; references 13: 8 Russian; 5 Western.
[259-1386]

VARIOUS MISCELLANEOUS ITEMS,
INCLUDING THEORIES

UDC 525.7

FEASIBILITY OF INDICATING AMMONIACAL POLLUTION OF THE ATMOSPHERE BY THE
RADIO-PHYSICAL METHOD

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23, No 5, May 80 pp 632-635
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[Abstract] The feasibility of indicating an increase of ammonia content in the atmosphere on the basis of intrinsic microwave radiation in the latter is considered by examining the frequency spectra and the fluctuation pattern of brightness temperature increments in various layers with various ammonia concentrations. The theoretical conclusions have been checked experimentally and necessary temperature corrections established which account for atmospheric humidity and characteristics of radiowave propagation near likely sources (industrial plants) of ammonia emission. Some reference is also established with pollution standards, which do not regard ammonia as a major pollutant. An important advantage of this radiophysical method over the more sensitive telemetric method using a CO₂-laser is its operativeness under conditions of low visibility. Figures 2; references 11: 10 Russian; 1 Western.
[273-2415]

UDC 537.58.001.5

A STUDY OF THE THERMIONIC EMISSION OF A SOLID-STATE SOURCE OF LITHIUM
IONS IN THE PULSED MODE

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KUL'VARSKAYA, B. S., MANTROVA, G. M. and YAKOVLEVA, M. N.

[Abstract] The patterns of thermionic emission of a solid-state Lithium ion source were investigated on specimens of sintered lithium aluminum silicate. The investigation was performed in the pulses mode, since in this case more stable ion currents are obtained. The ion current of these specimens was investigated as a function of emitter temperature and the magnitude and duty factor of the accelerating voltage. A critical duty factor, above which ion current becomes constant, was established. In the presence of an accelerating voltage of ~ 4 kv and an emitter temperature of 1100° C the ion current density reached 100 ma/cm² ($\tau = 5$ microsec, $f = 0.1$ Hz), which is 2-3 orders of magnitude higher than previously reported in the pertinent literature. These findings should serve as a basis for

optimizing the performance of the solid-state Lithium ion source. The authors thank N. P. Khablak for preparation of the active material for the Lithium ion source. Figures 5; references 6: 5 Russian; 1 Western. [259-1386]

UDC 537.525.001.24

EXCITATION OF STANDING STRATA IN A CONFINED POSITIVE COLUMN

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LANDA, P. S., MISKINOVA, N. A. and PONOMAREV, Yu. V.

[Abstract] Standing strata represent a manifestation of the ionization-diffusion instability of a positive column of low-pressure discharge, and they remain relatively uninvestigated. To fill this gap, the conditions of excitation and form of standing strata in a confined positive column are determined on the basis of the nonlinear hydrodynamic plasma model. It is shown that, to a linear approximation, with allowance for the boundary conditions corresponding to the absence of perturbations of concentration and temperature at the boundaries of the positive column, the excitation conditions are satisfied beginning with the lower spatial modes, and that stage-by-stage conditions of the ionization and excitation of standing strata are a major factor. The amplitude, length, and form of the strata in the neighborhood of the excitation boundary are derived from a solution of the corresponding nonlinear equation. The form of the strata is similar to that of a harmonic function exponentially decreasing from the cathode to the anode, differing from it only in the immediate neighborhood of the cathode. Figures 4; references 18: 12 Russian; 6 Western. [259-1386]

UDC 537.533.3

FORMATION OF PULSED MONOCHROMATIC BEAMS IN A HEAVY-CURRENT ELECTRON GUN

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SHVETS, V. A.

[Abstract] In the LIU-30/250 linear induction accelerator a major factor accounting for accelerated-electron beam losses is the nonmonochromaticity of the particles injected by the electron gun, i.e. the fact that the energies of the electrons injected at the leading and trailing edges of

pulses vary from zero to the rated level, which complicates the formation of the beam and its passage across the accelerator. The beam can be made monochromatic by using a time-selector (a pulsed single-loop magnetic deflector) mounted at the output of the electron gun in front of the first section of the accelerator. The electron-optical circuit and specific design features of the system developed to make the beam monochromatic are presented, with special attention paid to such components as the deflector section, the current receiver for the deflected electrons, and the monochromatic pulse-shaping circuits (which consist of nonlinear multi-channel peaking lines). Corresponding experiments, performed on the EEP-2 electron gun being developed as an injector for the LIU-30/250 accelerator, proved to be in agreement with the calculated findings. It was also found that the beam-monochromatizing system could be used in addition to measure the entire energy spectrum of the current from the electron gun with the aid of an oscilloscope. The author thanks Yu. A. Metelkin, V. B. Zabbarov, Yu. N. Komendantov and I. M. Mator for assistance in conducting the experiments on the EEP-2, as well as O. A. Strelin for consultation with respect to calculations. Figures 5; references: 2 Russian. [259-1386]

UDC 537.226

CALCULATING THE ELECTRICAL PARAMETERS OF ARENACEOUS-ARGILLACEOUS SOILS AT METER TO CENTIMETER WAVELENGTHS

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[Abstract] Soil can be regarded as a random mechanical mixture of solid particles (sand, clay), air, film moisture, and porous electrolyte. On this basis, the components of its dielectric permittivity ϵ' and ϵ'' are calculated as weighted sums of those of its various phases (according to R.A. BERENTSVEYG), with the moisture content allowed to increase from zero to saturation. The calculations cover the $\lambda_0 = 0.8-300$ cm range of wavelengths in free space, and they are based on experimental data and tables for soil at 18° C. These calculations can be extended to other temperatures, say from 0 to 40° C, if the temperature dependence of the electrical conductivity of weak electrolytes is taken into account. Figures 2; references 11: 7 Russian; 4 Western (1 in translation). [273-2415]

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